

Claim Status

1. (currently amended) For use with a tool for processing a work-piece at low pressure, a work-piece transfer system comprising:

- a) a first isolation load lock housed within a load lock housing for transferring a work-piece from a higher pressure region to a lower pressure region and back to said higher pressure region including first and second access openings facing said higher pressure region at different angles to allow the first load lock to be accessed from two different directions;
- b) a second isolation load lock housed within said load lock housing positioned next to the first work-piece isolation load lock for transferring a work-piece from a higher pressure region to a lower pressure region and back to said higher pressure region including first and second access openings facing said higher pressure region at different angles to allow the second load lock to be accessed from two different directions;
- c) a work-piece processing station for processing work-pieces at low pressure;
- d) a first robot for transferring work-pieces from one of said first and second work-piece isolation load locks to the work-piece processing station; and
- e) multiple other robots positioned in said higher pressure region outside the low pressure region for transferring work-pieces to and from the adjacent work-piece isolation load locks from a source of said work-pieces prior to processing and to a destination of said work-pieces after said processing wherein each of said multiple other robots is aligned in facing relation for moving workpieces through a specified one of said first and second access openings of a given load lock

~~wherein said first and second isolation load locks are housed within a load lock housing, said load lock housing including two load lock access openings facing said higher pressure region at different angles to allow each of the first and second load locks to be accessed from two different directions.~~

2. (currently amended) The transfer system of claim 1 additionally comprising a work-piece aligner for controlling an alignment of work-pieces moved through the first and second work-piece isolation load locks lock.

3. (currently amended) The transfer system of claim 1 wherein each said load lock housing includes a support for supporting a work-piece placed on the support within the load lock housing interior; and

a control valve for selectively venting a load lock housing interior to atmosphere and to a vacuum source for lowering the pressure within the load lock housing interior.

4. (currently amended) The transfer system of claim 1 wherein the first and second isolation load locks are spaced vertically from each other and wherein the first robot includes two spaced apart end effectors that can be moved into the first and second isolation load locks to obtain a work-piece.

5. (original) The transfer system of claim 4 wherein the spaced apart end effectors can be raised and lowered in relation to the load locks to allow either end effector to move into either of said first or second load locks.

6. (currently amended) For use with a tool for processing a work-piece at low pressure, transfer apparatus comprising:

a) an enclosure defining a low pressure region for processing of work-pieces at a work-piece processing station within the low pressure region;

b) two adjacent work-piece isolation load locks wherein each load lock includes:

i) ~~two~~ first and second access openings for selectively communicating atmospheric pressure to a load lock interior for transferring work-pieces to and from a region of atmospheric pressure wherein said two access openings confront said region of atmospheric pressure at different angles, and

ii) a third access opening for transferring work-pieces within the load lock interior to lower pressure for processing and back to said higher pressure subsequent to said processing;

c) a first robot for transferring work-pieces from the adjacent work-piece isolation load locks to a processing station within the low pressure region; and

d) multiple other robots positioned in said atmospheric region outside the low pressure region for transferring work-pieces to and from the adjacent work-piece isolation load locks from a source of said work-pieces prior to processing and to a destination of said work-pieces after said processing wherein each of said multiple other robots is aligned with at least in facing relation for moving workpieces through a specified one of said first and second access openings of a given load lock.

7. (original) The transfer apparatus of claim 6 wherein the adjacent work-piece isolation load locks are positioned one on top of the other.

8. (currently amended) The transfer apparatus of claim 7 wherein the two first and second access openings of a load lock open to allow work-pieces to be inserted along different travel paths and placed on a load lock support.

9. (previously presented) The transfer apparatus of claim 6 wherein the first robot moves the work-pieces in an arc to a transfer station.

10. (original) The transfer apparatus of claim 9 wherein the first robot has two end effectors, wherein each end effector can actively grasp a work-piece in either load lock.

11. (original) The transfer apparatus of claim 10 wherein the load locks are positioned one on top of the other and the work-pieces are generally flat wafers and further wherein the two end effectors move up and down along a direction transverse to a plane of the generally flat wafers.

12. (original) The transfer apparatus of claim 11 wherein the two end effectors are coupled to a movable carriage that moves the two end effectors simultaneously.

13. (currently amended) A process for serially processing multiple work-pieces at low pressure comprising:

positioning two load locks adjacent to each other wherein each load lock has first and second atmosphere access openings that confront a region of atmosphere at different angles;

providing a low pressure robot having two end effectors for moving work-pieces to a processing station from the two first and second load locks positioned adjacent to each other;

positioning multiple in-air robots in facing relationship with a specified atmosphere access opening of the two load locks for moving workpieces into and out of said two load locks;

moving grasping an unprocessed work-piece with one in-air robot and moving said unprocessed work-piece into to a first load lock of said two load locks through a first atmospheric load lock access opening having a facing relationship with said one in-air robot and placing the unprocessed work-piece inside the first load lock;

lowering the pressure within the first load lock;

removing the unprocessed work-piece from the first load lock with one end effector of said low pressure robot and moving the unprocessed work-piece to a processing station;

placing an already processed work-piece obtained from the processing station with a second end effector of said low pressure robot into one load lock of said first or second two load locks;

raising the pressure within the one load lock; and

removing the processed work-piece from the one load lock through a second specified atmospheric load lock access opening.

14. (original) The process of claim 13 wherein a processed work-piece is placed into the one load lock at the same time an unprocessed work-piece is being processed at the processing station.

15. (original) The process of claim 14 wherein the work-piece is a semiconductor wafer and wherein the low pressure robot delivers the wafer for placement onto a wafer chuck that attracts the wafer and further comprising reorienting the wafer and chuck prior to processing.

16. (currently amended) The process of claim 13 comprising positioning the two locks, one ~~load lock~~ above the other second load lock.

17. (currently amended) The process of claim 16 comprising moving the two end effectors of the low pressure robot up and down to enable either end effector to access work-pieces within either the ~~first or second~~ two load locks.

18. (currently amended) The process of claim 17 wherein the two end effectors are mounted collinearly to each other on a carriage that supports a drive motor for independently activating each end effector and further comprising moving the carriage up and down with respect to the two load locks to appropriately position an end effector with respect to a load lock.

Please cancel claim 19 without prejudice or disclaimer

19. (cancelled)

20. (currently amended) The process of claim 13 wherein the work-piece is a generally planar wafer and additionally comprising aligning an orientation of the wafer prior to inserting an unprocessed wafer into [[a]] the first load lock.

21. (currently amended) The process of claim 20 additionally comprising gathering providing first and second in air robots for moving the generally planar wafers to and from the load lock and wherein a first in air robot gathers a an unprocessed wafer from a source of wafers with a first in-air robot, places an placing the unprocessed wafer onto an aligner for orientation

and wherein a second in air robot removes an aligned wafer from the aligner for transfer through [[a]] the first load lock to the processing station.

22. (currently amended) The process of claim 13 wherein one or more additional unprocessed work pieces are moved sequentially from a source by an in air robot to the first ~~and second~~ load locks lock prior to removal of the processed work piece from the one load lock[[load]].

23. (currently amended) The process of claim 22 wherein alternate ones of the additional unprocessed work pieces are placed into alternate load locks of said ~~first and second~~ two load locks to allow a predecessor work piece to be removed from a pumped down load lock while an alternate load lock is opened to atmosphere for receipt of an unprocessed work piece.

24. (original) The process of claim 13 wherein a given work piece is removed after processing from the same load lock into which said given work piece was placed prior to processing.

Please cancel claim 25 without prejudice or disclaimer.

25. (cancelled)